RESPONSE TO PUBLIC COMMENTS

A greenhouse gas offset methodology for *Grazing Land and Livestock Management* (GLLM) was developed by Winrock International, with financial support from the David & Lucile Packard Foundation and technical input from a GLLM Technical Advisory Committee composed of:

- Shawn Archibeque, Colorado State University
- Richard Conant, Colorado State University
- Gustavo Cruz, UC Davis
- David Diaz, The Climate Trust
- Alan Franzluebbers, USDA – Agricultural Research Service
- Stephen De Gryze, Terra Global Capital
- Karen Haugen Kozyra, Prasino Group / BIGGS project
- Ermias Kebreab, UC Davis
- April Leytem, USDA – Agricultural Research Service
- Arvin Mosier, USDA – Agricultural Research Service (ret'd)
- Matt Sutton-Vermeulen, Prasino Group / BIGGS Project
- Juan Tricarico, Dairy Management Institute

The GLLM methodology was posted for public comment from December 20, 2012 – January 31, 2013. Public comments and responses by the authors are given below. A stakeholder consultation webinar was held January 22, 2013 and questions and answers from that webinar are also included below.

Following public consultation, the methodology will undergo a blind scientific peer review by experts in the fields of grazing land management, livestock management in the beef and dairy sectors, and GHG accounting. Peer review comments and responses are summarized in a separate document.

A. General

	Comment	Commenter	Response	Changes to Methodology
1.1	How is the impact of herd management change dealt with? For example, sales & purchases or transfers between beef & dairy herds can vary significantly year on year.	John Kazer, Carbon Trust Certification Limited	This is tracked through the methodology. For enteric and manure the baseline is not static but instead reflects changes in atmospheric conditions and changes in livestock numbers. The actual emissions and the business as usual baseline emissions will be evaluated year by year, so sales, purchases and transfers will be accounted for.	
1.2	Management choices, weather etc. often mean that herd fattening rates are variable and take > 12 months – how do you manage these impacts?	John Kazer, Carbon Trust Certification Limited	The methodology does not focus on specific practices but instead calculates estimates of emissions under business as usual and project activities. As such all should be captured.	
1.3	How does the methodology address the issue that impacts of any feed regime changes on the feed production emissions are not known (e.g. the risk of sourcing from deforested land in South America)?	John Kazer, Carbon Trust Certification Limited	Any reduction in product output (e.g. pounds of milk or meat produced) relative to baseline output by more than 3% requires Project Proponents to calculate market effects leakage using L-GLLM. The procedure uses price elasticities of supply and demand for	

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			dairy and beef products to calculate a market effects leakage factor, which is multiplied by the difference in output between baseline and project and baseline GHG emissions per unit output to calculate the market effects leakage deduction factor in tCO_2e. This is applied to the output of end products (beef and dairy), not to feed production emissions specifically. Consistent with other methodologies there is no explicit accounting of indirect land use change (ILUC) in other countries.	
1.4	The emphasis on modeling with nearly absent measurement and verification procedures for carbon stocks and GHG emissions, creates a precedence for extrapolating from assumptions and existing incomplete data sets and do not guarantee improvements and reductions are real. I strongly suggest this method incorporate rigorous science-based statistically sound measurement and reporting requirements so that verification is simply not a review of modeling exercises and accounting computations as it would primarily be with the way this method is presently	Steven Apfelbaum, Applied Ecological Services Inc.	In our long association with carbon project accounting we have always balanced atmospheric integrity with transaction costs. Where measurement is practicable and cost effective then it is always the choice. In this scenario the relative benefit of a pure measurement approach in our analyses makes this cost prohibitive. We have instead designed a system where models with the highest scientific integrity are used paired with field measurement for validation of model outputs. Where model outputs are divergent from field measurements, either a new modeling is required or additional field measurements.	

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	constructed.			
1.5	Can this project type be used for avoided conversion of grasslands to urban development or is it only for avoided conversion of grasslands to croplands?	Phillip Cunningham, Ruby Canyon Engineering	Neither. Avoiding conversion of grasslands to some other land use is not one of the eligible activities under this methodology. The methodology is very broad and non-prescriptive in terms of what activities are eligible, but it does require that project lands and facilities be used for grazing and livestock production in both baseline and project case. However ACR has another methodology, *Avoided Conversion of Grasslands & Shrublands to Crop Production* (see link), that applies to avoiding land use changes. This methodology has completed public comment and is currently in peer review, with expected publication in summer 2013.	
1.6	What effect does climate have on overall emission reduction tonnes (i.e. will there be more ERT's generated in the Southeast as opposed to dryer Midwest climates)?	Phillip Cunningham, Ruby Canyon Engineering	This is difficult to generalize. It is true that rainfall has a big effect on the emissions that result for example from fertilizer application or manure emissions on grasslands. Temperature likewise has a big effect on fertilizer, manure and enteric emissions. There are very complex interacting dynamics so it's not possible to make a blanket statement, but certainly region and climate will have an impact on how many emission reductions may result from the same activity	

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			implemented in different areas.	
1.7	Many livestock in the US are grazed on public lands. Can this methodology be used in that scenario, and what are the conditions for its use?	Webinar	Yes, grazing of livestock on public lands is permissible. Reductions in enteric, manure, fertilizer and fossil fuel GHG emissions related to these projects have no risk of reversal and may be registered as long as the Project Proponent can demonstrate clear ownership of the CO_2 reductions, which may require a letter from or MOU with the relevant public lands agency. Securing such an MOU should be facilitated by the fact that there is no long-term management commitment by the public agency required for these reductions, since they cannot be reversed subsequent to crediting. Projects seeking credit for enhanced biotic sequestration on public lands require a similar letter or MOU demonstrating that the responsible agency cedes offset ownership to the Project Proponent, and in order to mitigate the risk of future reversals, Project Proponents must make their buffer contribution in non-project ERTs. This is because ACR thinks it unlikely that the relevant public agencies will commit to maintain sequestered carbon on public lands for the Minimum Project Term, and therefore a buffer contribution from the project itself	

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			would not necessarily be available to mitigate a future reversal. However a buffer contribution from non-project ERTs would be available and (in the case the contribution comes from purchased ERTs from a project type such as landfill methane, SF_6 reduction, etc., will be irreversible). Note that per the *Forest Carbon Project Standard*, ACR always allows the buffer contribution to come from non-project ERTs, but in this case requires it to come from non-project ERTs.	
1.8	What about projects on leased lands? How do these claim credit if the project proponent is not the landowner?	Webinar	If the project proponent and project participants are not the landowner, they may claim credit for irreversible GHG reductions from enteric, manure, fertilizer and fossil fuel GHG emissions, provided they demonstrate that the landowner has ceded carbon offset ownership to the project proponent. If such projects wish to claim credit for enhanced biotic sequestration, the project proponent must demonstrate that the landowner has ceded carbon offset ownership to the project proponent, and additionally that the landowner has agreed not to change land use on the grazing lands for the duration of the Minimum Project Term. The landowner does not have to commit to participate in the project, or monitor and verify – this is the	

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			project proponent's commitment – but does have to agree not to change land use. The relevant applicability condition in FRAMEWORK-GLLM states that the project proponent "must demonstrate offset title and effective control over the GHG sources and sinks from which the credited reductions/ removal enhancements originate, for the duration of the specified Minimum Project Term. This applicability condition may be met by providing a letter from the landowner granting offset title to the Project Proponent and guaranteeing no change in land-use for the duration of the Minimum Project Term."	

B. FRAMEWORK-GLLM

	Comment	Commenter	Response	Changes to Methodology
2.1	Thanks for providing provisions and structure for early adopter involvement in this program.	Steven Apfelbaum, Applied Ecological Services Inc.	Thanks for the comment. We agree early adopter provisions appear critical to producer participation in many agricultural GHG offset activities.	
2.2	On the subject of additionality, and the inclusion in your protocol of an early adopters mechanism to give	Bob Wagner, New England Farmers	We appreciate the commenter's support of the methodology's early adopters mechanism. We agree not specifying the region over which	A new definition of Reference Region has been added to section

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	credit to those farmers that may have previously adopted a practice "as long as that activity is at very low rates of adoption in their region": it will be important to know what metrics will be used to determine "very low rates of adoption." This will be critical in New England where a number of techniques that otherwise may produce carbon credits have been implemented by dairy farmers already purely because of their cost-cutting/efficiency values. In some sub-regions of the Region, adoption rates may be very high. However, when judged across the entire Region or maybe even a State, we could show that these techniques are still in the pioneering phase. Specifically, section 5.5 Early Adopters in the FRAMEWORK-GLLM module lays out a useful proposal for assessing rates of adoption, and allowing producers who have adopted practices for which the baseline rate of adoption remains below 5% to use a common practice baseline. However this section does not give sufficient guidance how to define the "reference	Union	adoption rates of a particular practice must be evaluated ("Reference Region") was an important oversight in the public comment draft. Without guidance on defining the Reference Region, section 5.5 will not be usable. We considered three options for defining the Reference Region in which common practice adoption rates should be evaluated, summarized below with advantages (+) and disadvantages (-): • State boundaries: (-) often not correlated with climate or soils, which may drive management practices, (+) statistics may be available at the state level from NASS, ERS, or extension services • MLRA: (-) may be too large to be useful for livestock projects, (+) follows natural soil and climate boundaries • Boundaries based on concentration of livestock practices. (-) requires extra work to delineate areas, (+) most accurate in terms of livestock regions Considering feasibility and data availability, we have decided to use state boundaries. A second decision is whether the adoption rates of particular GLLM practices within	3.0 of the module. Section 5.5, Early Adopters, has been revised as follows: • Indicating that Project Proponents wishing to use the early adopters provisions and credit based on a common practice baseline must evaluate adoption rates of GLLM activities over the Reference Region, defined as the U.S. State (or similar jurisdiction, i.e. state or province, in other countries). • Indicating that Proponents of a new project may review existing validated GHG Project Plans to see whether an

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	region" in which a survey is conducted (or for which expert opinion on adoption rates is sought). It will make a big difference whether this reference region is defined at the county, state, regional or other level.		Reference Regions should be analyzed upfront, by the methodology author, and included in the methodology; or instead the methodology simply provide the option for Project Proponents who wish to register early adopter activities using a common practice baseline to assess adoption rates. Because this methodology is open-ended with respect to practices, relying on the Project Proponent/livestock producer to select the eligible project activity, we have opted for the latter. Finally, we believe there should be some mechanism for Project Proponents to determine whether a prior project has already evaluated adoption rates of the same practice within the same Reference Region. If this analysis has been done credibly and validated, subsequent projects should be able to use the same adoption rates, at least for a limited time (since adoption rates of any practice change over time). To this end, the methodology stipulates that: 1. Project Proponents of a new project using the early adopters provisions in section 5.5 should review existing validated GHG Project Plans for GLLM project activities. If the adoption rate	adoption rate analysis has already been done for the same GLLM practice in the same Reference Region. If so, for at most 10 years after the date of the validated GHG Project Plan, the Proponent of the new project may use that adoption rate and is not required to conduct his own adoption rate analysis.

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			of the same GLLM practice in the same Reference Region has been analyzed and is included in a validated GHG Project Plan dated no more than 10 years prior to the date of project registration, Project Proponents may use this adoption rate and are not required to conduct their own adoption rate analysis via survey data or expert opinion. If more than one validated GHG Project Plan has an adoption rate analysis for the same GLLM practice in the same Reference Region, the average of the published adoption rates must be used. 2. As GLLM project activities are registered, ACR may publish a subsequent versions of this GLLM Methodology that include the baseline adoption rates for particular GLLM practices and Reference Regions, along with the length of time for which these adoption rates may be used before a new baseline adoption rate analysis is required.	
2.3	How would one determine if the adoption of any given practice is above or below the 5% threshold for	Webinar	The threshold test can be presented through publically available survey data, actual surveys of ranchers conducted by project proponent,	

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	the project area and how specific does the project area need to be?		or expert opinion justified to the validator. On the question of defining the reference region in which the 5% adoption rate is evaluated, see response to question 2.2.	

C. A-MICROSCALE

	Comment	Commenter	Response	Changes to Methodology
3.1	[Microscale documentation, page 17] This section calls for accounting of N in bedding, but high C bedding has the potential to mitigate N losses from manure and urine, which does not appear to have been considered. Particularly true if composted. I know this is standard in NRCS nutrient planning as well, but considering N in bedding as additive to the N total seems to miss the potential for high C bedding to effectively tie up N in manure and mitigate N losses from manure.	Jeffrey Creque, McEvoy Ranch	Currently the A-MICROSCALE tool follows IPCC equations and default values for estimating the amount of nitrogen in managed manure attributable to bedding materials (2006 IPCC Guidelines for AFOLU). It is noted in these guidelines that bedding materials vary greatly, limited data exist and users should develop values based on the characteristics of bedding material used in their own livestock production systems. The MICROSCALE tool currently uses an IPCC default for N from bedding of 7 kg N animal-1 yr-1 for cows and heifers and 4 kg N animal-1 yr-1 for other cattle. As more data become available for this aspect of the accounting, we will consider modifying the tool to consider the impacts of bedding materials on N2O emissions in more detail. Although high C bedding may mitigate N losses as part of the manure management	

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			system, if the N retained in the manure is then applied to managed soils, then unless the N becomes permanently fixed the N will still be emitted, the emission simply will be moved from being accounted in the manure module to being accounted in the fertilizer module.	

D. A-SMALLSCALE

	Comment	Commenter	Response	Changes to Methodology
4.1	Why was COMET 2.0 used rather than COMET-FARM? If COMET-FARM will be used in the future, how will this transition happen in the methodology?	Webinar	COMET-FARM was not used simply because at the time of methodology drafting, the ability to account grassland and grazing land changes in soil carbon, as well as emissions of enteric and manure GHGs, were not available in the current publicly available versions of COMET-FARM (which remains in development by USDA and Colorado State University). As a result we couldn't set the criteria or provide guidance on how COMET-FARM would be used. When COMET-FARM becomes publicly available, it will be easy to make the switch from COMET 2.0 to COMET-FARM. If the methodology approval process is completed before a version of COMET-FARM including the above capabilities becomes publicly available, the methodology will	

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			specify COMET 2.0 as currently, and when COMET-FARM becomes available, a relatively straightforward methodology revision can be made to the A-SMALLSCALE module. Such revisions are done through ACR's AFOLU Technical Committee. If COMET-FARM becomes available before the peer review process is complete for this GLLM methodology, we may be able to switch to it before publishing the methodology.	

E. A-ENTERIC

	Comment	Commenter	Response	Changes to Methodology
5.1				

F. A-MANURE

	Comment	Commenter	Response	Changes to Methodology
6.1	Methane, N2O, Ammonium, etc are serious GHG's emitted from manure lagoons and feedlots and these are neither addressed, and are glossed over by suggesting without comprehensive description in this	Steven Apfelbaum, Applied Ecological Services Inc.	We don't understand how the commenter has interpreted the methodology to exclude or gloss over methane and N_2O from manure management. Table 1 of FRAMEWORK-GLLM, which defines the GHG sources, sinks and reservoirs included and excluded from	

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	method, that these are negligible and excluded from the method. Because a very highly significant percentage of emissions from dairy and beef operations arise from these sources, this method falls far short of being able to address one of the most critical areas of livestock and grazing management GHG sources of emissions.		accounting, makes clear that CO_2, CH_4 and N_2O from manure emissions from dairy and beef cattle are included in the GHG assessment boundary and therefore must be accounted. Ammonium is not a Kyoto Protocol greenhouse gas. Meanwhile these gases are accounted in the accounting modules for all three scales. CH_4 is accounted from floor of barns and feedlots, and from enclosed and unenclosed storage. N_2O is accounted from bedded pack floors and dry lot floors and from storage stacked or in slurry with a crust.	
6.2	Is a project eligible under this methodology that is only installing a digester or making other changes to an existing manure management system?	Webinar	Yes, this could be eligible. This is a project activity for which multiple methodologies are available. The GLLM methodology is designed for grassland and grazing land, but emissions from handling of manure are part of the accounting. For projects installing a biogas control system on dairy or swine operations, and wishing to create California-compliant offsets, projects may also be registered on ACR under the CA Air Resources Board's Compliance Offset Protocol – US Livestock Projects. See http://americancarbonregistry.org/carbon-accounting/california-compliance-offsets.	

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6.3	In the manure management section, we questioned whether there are potential tradeoffs between NH_3 and N_2O emissions with practices such as injection of manure into crop fields. Might be worth looking into.	Dana Gunders, Natural Resources Defense Council	It might be, but we are not in the position to do original science only the consolidation of accepted existing scientific findings. We worked off the science in DAIRYGEM. If you have literature, we are willing to consider incorporation.	

G. A-FERTILIZER

	Comment	Commenter	Response	Changes to Methodology
7.1	There seems to be a choice of models for use in the Fertilizer module. How would a project developer determine that any specific model were acceptable for use under this methodology?	Webinar	A-FERTILIZER gives specific acceptability criteria for a model to be used, and recommend some models that meet these criteria. See section 1.1. If the project proponent desires to use a different model from the examples given in the module, they would need to justify to the validator that their chosen model meets the criteria given in the module. In addition to meeting those applicability criteria, the project proponent would need to show that the model is applicable to the area, e.g. by citing studies in which the model has been used in similar edaphoclimatic conditions to the project area and has been shown to be applicable. So, several steps are required, which is why we have only required such	

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			models to be used in the large-scale modules (i.e. if *ex ante* estimated emissions are above the 60,000 tCO_2e threshold). No model justification is required under the MICROSCALE and SMALLSCALE modules.	

H. A-BIOTIC

	Comment	Commenter	Response	Changes to Methodology
8.1	[Comment also applicable to A-SMALLSCALE, which uses COMET 2.0] This method fails to understand that models predicting existing soil carbon stocks (total, organic and inorganic carbon present in soils) for grazing lands (e.g. in western USA) are not accurate. In our studies of soil carbon levels in NM, OR, TX, NV, UT, CO, Century, Comet and EPIC/APEX predicted levels that were typically 1 – 2 orders of magnitude in error of what we actually measured. We suggest that the TEP soil carbon quantification method perhaps be incorporated by reference and used to verify range, variance of soil carbon	Steven Apfelbaum, Applied Ecological Services Inc.	I think the scientists who have spent their careers developing such models would be greatly offended by the claim they are not accurate. And it questions detailed processes that are carried out to approve accounting approaches used by governments, regional programs and also climate change mitigation projects. The models have been demonstrated to be accurate by significant peer-reviewed literature. Throughout our many years in this field we have balanced the highest atmospheric integrity with transaction costs of implementation. This is exactly what is done here with field measurement required for validation of modeling output. Where	

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	levels.		modeling output is divergent, either the model has to be rerun or more field data is required. We believe requiring the use of field measurements of soil carbon to validate model outputs, rather than requiring crediting to be based on field measurements alone, in many cases strikes the right balance between operational feasibility, cost, and accounting rigor. Field measurements are of course also subject to error.	
8.2	Soil erosion, non-woody litter stocks, graminoid standing stocks, bare soil and vegetation ground surface, are all excluded from measurement in this method which neglects some of the most basic measurements to understand land condition. As well, biodiversity measurements, invasive species composition of the landscape, are also neglected which is most unfortunate as many of the impacts of livestock and dairy cattle grazing result from direct and indirect changes in composition and structure of plant communities and resultant changes in soil carbon stocks, erodibility, soil compaction, soil	Steven Apfelbaum, Applied Ecological Services Inc.	Graminoid standing stocks are included. The models require detailed information on necessary factors for modeling soil carbon stocks. The other suggested measurements – biodiversity, invasive species, erodibility, soil compaction, etc. – are outside the scope of a GHG methodology, though some are addressed at the level of the *ACR Standard* through the requirement that Project Proponents demonstrate net positive community and environmental impacts.	

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	structure, etc. This method falls far short of encompassing these most important determinants of range/pasture health and thus the capacity and performance of soil systems under varying rotational strategies, fertilizer strategies, and short and long term land management decisions by individual farmers and ranchers.			
8.3	Are existing or planted trees required to be measured for all project activities?	Webinar	No. The only situation in which the project proponent would be *required* to measure trees is if the project activity were going to cause a significant decrease in their stocks. If trees are pre-existing, there would be no difference between baseline and project and thus no need to account. If the project is able to enhance biotic sequestration, it would be up to the project proponent whether to account for this and claim credit. The general conservativeness principle is that projects are only required to account for increased emissions or decreases in sequestration. It is up to the project proponent whether to account for and claim credit for decreases in emissions or increased sequestration.	

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8.4	Section 1.3 Baseline (page 5) reads "The carbon stock in the baseline case shall be equal to the equilibrium stock in soil organic carbon and living biomass." I believe this statement should read: "The carbon stock in the baseline case shall be equal to the stock in soil organic carbon and living biomass".	Jeffrey Creque, McEvoy Ranch	The equilibrium stock refers to the fact that if carbon stocks are in a current transition such as recovering from previous degradation the stock used shall be the stock when a new stable level has been reached.	
8.5	The module does not explicitly incorporate the potential for avoided conversion of grasslands (to crop agriculture, for example) and restoration of grasslands (i.e. from crop agriculture to perennial pasture, or from degraded land to improved pasture), presumably due to additionality concerns.	Dana Gunders, Natural Resources Defense Council	It is correct that avoided conversion of grasslands to croplands is not eligible under this GLLM methodology but is specifically addressed in a separate methodology entitled *Avoided Conversion of Grasslands and Shrublands to Crop Production*, which is currently going through the ACR approval process with expected publication in summer 2013. Restoration of grasslands from crop agriculture to perennial pasture, or from degraded land to improved pasture, would indeed be eligible under this GLLM methodology. Additionality must be proven in both methodologies.	
8.6	The third approach to grazing land offsets – improved management – can be challenging, particularly in arid or semi-arid rangelands.	Dana Gunders, Natural Resources Defense	The methodology is not intended solely for use on arid or semi-arid rangelands. Even on such rangelands, we expect the ability to achieve net GHG emission reductions or enhanced biotic sequestration will vary	

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	• Booker et al. (2012)[1] state that: "Carbon uptake on arid and semi-arid rangelands is most often controlled by abiotic factors not easily changed by management of grazing or vegetation. Additionality may be impossible to achieve consistently through management on rangelands near the more xeric end of a rangeland climatic gradient…it is possible that current proposed carbon policy as exemplified by carbon credit exchange or offsets will result in a net increase in emissions, as well as investment in failed management. Rather than focusing on annual fluxes, policy and management initiatives should seek long-term protection of rangelands and rangeland soils to	Council	depending on the project site, baseline management and proposed project activity. The methodology does not suggest it will always be possible to achieve a net GHG reduction. The quote from Booker et al. (2012) that "Additionality may be impossible to achieve…" seems like both a gross generalization and a misuse of the term. Additionality refers to the ability to demonstrate that a project activity is not effectively required by applicable regulations, and is not likely to occur in a conservative business-as-usual scenario. If this is the intended use of the term here, we do not see how the authors could argue that the full range of conceivable improved rangeland management practices are likely to be required by regulations or to be business-as-usual. If the authors are misusing the term to refer to a net decrease in GHG emissions/increase in sequestration when compared to the baseline scenario, we reiterate our comment above: it is true that some practices implemented on some	

[1] Booker, K., L. Huntsinger, J.W. Bartolome, N.F. Sayre, and W. Stewart. 2012. What can ecological science tell us about opportunities for carbon sequestration on arid rangelands in the United States. Global Environmental Change, 12 pages.

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	conserve carbon, and a broader range of environmental and social benefits." • See Eagle et al. (2012)[2] for a review of the literature that discusses differences in sequestration potential for mesic vs. more arid rangelands, as well as the effectiveness of different rangeland and pasture management practices at achieving emissions reductions.		rangelands will not result in a net GHG reduction or enhancement in sequestration, but this is not true for all practices implemented on all eligible grazing lands. The authors have reviewed the Eagle et al 2012 publication and contributed to related T-AGG publications. It is an excellent general resource, but does not support the contention that no improved grazing management practices can result in a net GHG reduction or enhancement in sequestration.	
8.7	Given that the module focuses on the sequestration potential of improved livestock management, most of our concerns have to do with the potential for heterogeneity in sequestration rates (e.g. due to climate, soil type and condition, types of grasses) that is not accounted for in the A-Biotic module or the smaller-	Dana Gunders, Natural Resources Defense Council	We are not sure what heterogeneity will not be captured. Climate is measured and will vary through time and be entered into the models used. Soil type should be a source of stratification for the modeling results, types of grasses should be an entry option in the models.	

[2] Eagle, A., L. Olander, L.R. Henry, K. Haugen-Kozyra, N. Millar, and G.P. Robertson. 2012. Greenhouse Gas Mitigation Potential of Agricultural Land Management in the United States: A Synthesis of the Literature. Report NI R 10-04, Third Edition. Durham, NC: Nicholas Institute for Environmental Policy Solutions, Duke University.

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	scale modules.			
8.8	There are different risks to soil carbon pools in grasslands and rangelands when compared to forests, particularly related to the low stature and high exposure of vegetation to sunlight and wind, and risks that disturbances will accelerate losses of carbon pools from grasslands. Additionally, rangelands in particular tend to be characterized by unpredictable climates, making prediction of sequestration rates challenging. The reliance on measurement protocols for forest carbon (pages 7-8) raises concerns that key risks to grassland sequestration might be overlooked.	Dana Gunders, Natural Resources Defense Council	Note that page 7-8 of A-BIOTIC is really about assessing non-permanence risk using the tool, not "measurement protocols," so we understand this comment to refer to use of the existing VCS AFOLU non-permanence tool for the reversal risks to sequestered carbon in rangelands. Reversal in a forested landscape can lead to a dramatic and sudden loss in stocks. Reversals from soils will be more gradual. The most extreme case is where a project is abandoned and the entire stock sequestered since project start is lost. This should be covered by the pooled buffer under any circumstance. Note that the methodology does require measurement of soil carbon in order to verify the modeled results.	
8.9	The protocol suggests that the project should be stratified into "relatively homogeneous units" and that the project proponent should "present in the GHG Project Plan an ex-ante stratification of the project area, or justify the lack of it". There is no clear mention of how the protocol accounts for the confounding influence of	Dana Gunders, Natural Resources Defense Council	Stratification should capture all the sources of variation that you mention. However we agree there can be value in adding factors that should be considered during stratification.	Footnote added: [1] Stratification factors that should be considered include: slope, aspect, topography, proximity to water, landcover type/ landcover

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	heterogeneous physical factors that influence C sequestration rates in grazing lands, or instructions for what factors necessitate stratification. Possible factors include slope, topography, proximity to water, and ecoregions/landcover types. • Derner et al. (2006)[3] found that within the same ecoregion (Great Plains Grassland), grazed shortgrass communities had 24% more carbon storage when compared to ungrazed sites. In contrast, grazed mid and tallgrass communities stored 8% less carbon when compared to ungrazed sites. • Mc Sherry and Ritchie (2013) found that Soil Organic Carbon responded differently to grazing in C3-dominated vs. C4-dominated grasslands, and concluded that "grazer effects on SOC are highly context-			species, soil type.

[3] Derner, J.D., T. W. Boutton. And D.D. Briske. 2006. Grazing and ecosystem carbon storage in the north American Great Plains. Pland and Soil 280:77-90.

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	specific and imply that grazers in different regions might be managed differently to help mitigate greenhouse gas emissions." Recommendation: Provide specific examples of relevant factors that impact net sequestration and that should be considered as strata if there is anticipated heterogeneity within the project. These factors could include aspect, slope, topographic position, soil type, or plant community type (e.g. using Ecological Site Descriptions and/or Forage Suitability Groups			
8.10	On page 2 of A-Biotic, soil carbon stocks are measured taking into account crop grass and crop/grassland management type, livestock presence/type/number, and manure applied. Nonetheless, the protocol recommends on Page 3 that "model inputs are validated from country or region-specific locations that are representative of the variability of climate, soil and management systems in the country."	Dana Gunders, Natural Resources Defense Council	We will add the additional factors you mention.	Footnote added: [1] Stratification factors that should be considered include: slope, aspect, topography, proximity to water, landcover type/ landcover species, soil type.

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	Is there a way to more explicitly include the importance of soil type, topography, or other influences on sequestration, here?			
8.11	As part of quantification (pages 3-4), the protocol states that, for the soil carbon pool, output "shall vary by stratum, where variation exists in historical use and management, current management, and edaphoclimatic factors," and for the living biomass carbon pool, the protocol states that output "shall vary by stratum, where variation exists in vegetation types/species, historical use and management, current management, and edaphoclimatic factors". For both, the implication is that the model should be run for every stratum, but again, there should be clearly-stated, specific examples of strata to guide users.	Dana Gunders, Natural Resources Defense Council	OK	Footnote added: [1] Stratification factors that should be considered include: slope, aspect, topography, proximity to water, landcover type/ landcover species, soil type.
8.12	At least one of the optional models (Century; page 2) has been criticized for its performance in arid and semi-	Dana Gunders, Natural Resources	The methodology requires that there "be studies (for example: scientific journals, university theses, local research studies or work carried out by the Project Proponent)	

	Comment	Commenter	Response	Changes to Methodology
	arid rangelands. • Brown et al. (2010)[4] state that "The model performed poorly on arid and semiarid rangelands for both management (reduced stocking) and restoration (legume addition) practices. Only 66% of land area currently used as rangeland had climate, soil, and management attributes that resulted in acceptable uncertainty." The same authors (Brown et al., 2010) suggest the following to improve the model: • "To overcome these limitations, we propose an integrated system of spatially-explicit direct measurement and soil carbon at locations with well-documented management histories and	Defense Council	that demonstrate that the use of the selected model is appropriate for: a) the IPCC climatic regions of 2006 IPCC AFOLU Guidelines or b) agroecological zone (AEZ) in which the project is situated using one of the options presented"	

[4] Brown, J., J. Angerer, S.W. Salley, R. Blaisdell, and J.W. Stuth. 2010. Improving estimates of rangeland carbon sequestration potential in the US Southwest. Rangeland Ecology and Management 63:147-154.

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	climatic records to better parameterize the model for rangeland applications" Importantly, they also note that "because the drivers of soil carbon fluxes on rangelands are dominated by climate rather than management, the interface should be redesigned to simulate soil carbon changes based on ecological state rather than practice application." Recommendation: If possible, Include a list of model strengths and weaknesses, or some helpful criteria for choosing the most appropriate model for the system type and location, within the protocol.			

I. L-GLLM

	Comment	Commenter	Response	Changes to Methodology
9.1				